WHAT IS CLAIMED IS:

1. A wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node;

means for sharing said spare optical path among said current optical paths having different routes;

means for, when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite

node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

means for, when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

2. A node of a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a

route reverse to said current optical path extending from said start node to said end node;

means for sharing said spare optical path among said current optical paths having different routes;

means for, when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

means for, when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

3. A wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in

which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node; and

means for sharing said spare optical path among said current optical paths having different routes.

4. A system according to claim 3, further comprising means for setting said current optical path between nodes by a shortest route.

5. A system according to claim 3, further comprising means for setting said current optical path and said spare optical path in two ways between nodes.

6. A wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in

which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node;

means for sharing said spare optical path among said current optical paths having different routes, and, when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

means for, when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

7. A wavelength division multiplexing ring

network system which comprises a plurality of nodes for transmitting and receiving a plurality of optical signals having different wavelengths, terminating optical paths, and switching connections of said optical paths, and a network manager connected to at least one node, and in which said nodes are connected into the form of a ring via at least a clockwise optical transmission line and a counterclockwise optical transmission line, and an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

means for setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node,

said network manager including optical path requesting means for requesting at least one node forming an optical path to set an optical path;

said node including optical path setting means for setting an optical path between nodes forming an optical path on the basis of the request from said network manager;

said optical path requesting means including means

for checking whether an optical path can be set, means for determining a node to be requested to set an optical path, and means for checking whether said spare optical path can be shared,

said optical path setting means including means for setting an insertion wavelength of an optical path, means for setting a conversion wavelength of an optical path, and means for setting a branching wavelength of an optical path,

said means for checking whether said spare optical path can be shared including means for determining that said spare optical path can be shared when routes of said current optical paths set between nodes do not overlap, and requesting at least one node to set an optical path so as to form a new spare optical path by sharing an existing spare optical path, and

said optical path setting means including means for forming a new spare optical path by sharing a wavelength used by an existing spare optical path, when requested by said network manager to form the new spare optical path by sharing the existing spare optical path.

8. An optical path setting method in a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a

plurality of nodes connected into the form of a ring via the transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of the optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node;

sharing the spare optical path among the current optical paths having different routes;

when a node which terminates the current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both the current optical path and the spare optical path, sending an alarm signal to an opposite node of the current optical path having the trouble, and switching inputting of optical signals to the spare optical path; and

when a node which terminates the current optical path detects the alarm signal, outputting an optical

signal to both the current optical path and the spare optical path, and switching inputting of optical signals to the spare optical path.

9. An optical path setting method in a wavelength division multiplexing ring network system which comprises a plurality of nodes for transmitting and receiving a plurality of optical signals having different wavelengths, terminating optical paths, and switching connections of the optical paths, and a network manager connected to at least one node, and in which the nodes are connected into the form of a ring via at least a clockwise optical transmission line and a counterclockwise optical transmission line, and an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising the steps of:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node;

causing the network manager to request at least one node forming an optical path to set an optical path;

causing the node to set an optical path between nodes forming an optical path on the basis of the request from the network manager;

causing optical path requesting means to check whether an optical path can be set, determine a node to be requested to set an optical path, and check whether the spare optical path can be shared;

causing optical path setting means to set an insertion wavelength of an optical path, set a conversion wavelength of an optical path, and set a branching wavelength of an optical path;

causing means for checking whether the spare optical path can be shared to determine that the spare optical path can be shared when routes of the current optical paths set between nodes do not overlap, and request at least one node to set an optical path so as to form a new spare optical path by sharing an existing spare optical path; and

causing optical path setting means to form a new spare optical path by sharing a wavelength used by an existing spare optical path, when requested by the network manager to form the new spare optical path by sharing the existing spare optical path.

10. An optical path setting method in a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a

counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via the transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of the optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node; and

sharing the spare optical path among the current optical paths having different routes.

11. A method according to claim 10, wherein the current optical path is set between nodes by a shortest route.

12. A method according to claim 10, wherein the current optical path and the spare optical path are set in two ways between nodes.

13. A recovery method in a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a

clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via the transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of the optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, comprising:

setting a current optical path on a route via the clockwise or counterclockwise optical transmission line extending from the start node to the end node, and setting a spare optical path on a route reverse to the current optical path extending from the start node to the end node;

sharing the spare optical path among the current optical paths having different routes;

when a node which terminates the current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both the current optical path and the spare optical path, sending an alarm signal to an opposite node of the current optical path having the trouble, and switching inputting of optical signals to the spare optical path; and

when a node which terminates the current optical path detects the alarm signal, outputting an optical signal to both the current optical path and the spare optical path, and switching inputting of optical signals to the spare optical path.

14. A program for setting an optical path in a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node;

sharing said spare optical path among said current

optical paths having different routes;

when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.

15. A program for setting an optical path in wavelength division multiplexing ring network system which comprises a plurality of nodes for transmitting and receiving a plurality of optical signals having different wavelengths, terminating optical paths, and switching connections of said optical paths, and a network manager connected to at least one node, and in which said nodes are connected into the form of a ring via at least a clockwise optical transmission line and a counterclockwise optical transmission line, and an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is

received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node;

causing said network manager to request at least one node forming an optical path to set an optical path;

causing said node to set an optical path between nodes forming an optical path on the basis of the request from said network manager;

causing optical path requesting means to check whether an optical path can be set, determine a node to be requested to set an optical path, and check whether said spare optical path can be shared;

causing optical path setting means to set an insertion wavelength of an optical path, set a conversion wavelength of an optical path, and set a branching wavelength of an optical path;

causing means for checking whether said spare optical path can be shared to determine that said spare optical path can be shared when routes of said current optical paths set between nodes do not overlap, and request at least one node to set an optical path so as

to form a new spare optical path by sharing an existing spare optical path; and

causing optical path setting means to form a new spare optical path by sharing a wavelength used by an existing spare optical path, when requested by said network manager to form the new spare optical path by sharing the existing spare optical path.

16. A program for setting an optical path in a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to

said end node; and

sharing said spare optical path among said current optical paths having different routes.

17. A program according to claim 14, further comprising a program for causing said computer to execute the procedure of setting said current optical path between nodes by a shortest route.

18. A method according to claim 16, further comprising a program for causing said computer to execute the procedure of setting said current optical path and said spare optical path in two ways between nodes.

19. A program for realizing a recovery method in a wavelength division multiplexing ring network system which comprises an optical transmission line including at least a clockwise optical transmission line and a counterclockwise optical transmission line, and a plurality of nodes connected into the form of a ring via said transmission line to transmit and receive a plurality of optical signals having different wavelengths, terminate optical paths, and switch connections of said optical paths, and in which an optical path having an arbitrary wavelength is set by which an optical signal transmitted from an arbitrary start node through an arbitrary optical fiber is received by an arbitrary end node, said program causing a computer to execute the procedures of:

setting a current optical path on a route via said clockwise or counterclockwise optical transmission line extending from said start node to said end node, and setting a spare optical path on a route reverse to said current optical path extending from said start node to said end node;

sharing said spare optical path among said current optical paths having different routes;

when a node which terminates said current optical path detects a trouble pertaining to reception of an optical signal, outputting an optical signal to both said current optical path and said spare optical path, sending an alarm signal to an opposite node of said current optical path having the trouble, and switching inputting of optical signals to said spare optical path; and

when a node which terminates said current optical path detects the alarm signal, outputting an optical signal to both said current optical path and said spare optical path, and switching inputting of optical signals to said spare optical path.